

REMARKS

Reconsideration of the Application is respectfully requested.

I. Claim Status

Claims 1-4, 15, and 16 are currently pending. Claims 5-14 have been withdrawn. Claims 1 and 2 have been amended. Support for these amendments come from the Applicant's specification at paragraphs 0015, 0018, 0065, 0114, and 0117. No new matter has been added.

II. Specification Objections

In paragraph 0005, reference numeral 42 has been added to the AIN base plate. Since a circuit layer 43 is laminated on the first side of the AIN base plate and a metal layer 44 is laminated on the second side of the AIN base plate, it is obvious that the object 42 shown in FIG. 9 corresponds to the AIN base plate. In addition, several typographical errors have been corrected.

Replacement Figure 9 has been designated by a legend and the objection to the drawing is therefore moot.

The abstract of the disclosure was objected to by the Examiner because it was not clear what "less than 5" referred to in regards to units. Correction of the abstract to include an explanation of how "less than 5" is measured is included. Applicant respectfully submits that the specification does not need to be clarified as paragraph 0013 of the Applicant's specification recites how the amount of boron as measured by X-ray fluorescence analysis is defined.

III. Claim Objections

The Examiner objected to claims 1 and 2 because the phrase "less than 5" was devoid of any supporting language and because it was not clear what the "remaining amount" is remaining from (i.e. what the source of boron was.) Claims 1 and 2 have been amended to indicate that the source of boron is from the release agent and that the phrase "less than 5" is the amount of boron as defined as a value obtained by the expression: $(\text{a peak height of B-K}\alpha / \text{a peak height of X-K}\alpha) \times 100000$. Based on the expression, it is clear that less than 5 can be expressed as a number without units.

IV. Rejections

Claims 1-2 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,013,357 ("Sakuraba"). The Examiner contends that Sakuraba teaches a base plate for a power module comprising a metal plate, a ceramic base plate joined to the metal plate and a release agent (BN) provided in a joint surface between the metal plate and the ceramic base plate. The Examiner states that Sakuraba discloses that x-ray diffraction is used to analyze the intensity of remaining boron on the surface of the ceramic substrate and that it would have been obvious to one skilled in the art to keep the remaining amount of boron at a low level. The Examiner further contends that the direct bonding of the ceramic and metal plates would have inherently created a crystal grain straining region in the joint surface and that it would have been obvious to one skilled in the art to optimize the range to 40% or less.

Applicant respectfully traverses the rejection.

It would not have been obvious to one of ordinary skill in the art to have a metallic crystal grain straining region within a certain extent combined with a remaining amount of a release agent to be less than 5 as measured by a fluorescence X-ray analysis. Honing is performed on the surface of the ceramic base plate so that a remaining amount of the release agent is less than 5 as measured by fluorescence X-ray analysis. (Applicant's specification, paragraph 0072.) When the remaining amount of the release agent is less than 5, a decrease in joint performance can be prevented. This is illustrated in Fig. 3. Furthermore, Fig. 3 illustrates that there is a trade-off relationship between the remaining amount of the release agent and the amount of damage on the joint surface. A high joint strength can be obtained in a state in which both the remaining amount of release agent and the amount of damage are low. Sakuraba does not disclose that one of the effects of honing can be increased damage on the joint surface, nor does Sakuraba disclose that there is a trade-off relationship between honing, the amount of left over release agent, and the amount of damage on the joint surface.

Furthermore, ceramic is difficult to strain without breaking. The Examiner states that "the direct bonding of the ceramic and metal plates would have inherently created crystal grain straining in the joint surface." The strain of the ceramic crystal grain is generated not by being joined to a metal plate, but by a grinding or honing before being joined to the metal plate.

Therefore, the crystal grain straining region was not inherent; it was a variable that was tested by the Applicant when making this invention. (See Applicant's specification, paragraph 0113.) The first evaluation of the joint surface was an observation of strain caused by damage due to the surface treatment, i.e. the honing as described in paragraph 0110. As shown in Table 1 of the specification of Applicant's application, strains of the ceramic crystal grain have a serious effect on the joint strength of the ceramic base plate and the metal plate after a temperature cycle.

The high joint strength as evidenced in both an initial state and after a temperature cycle is due to a synergistic effect of both required qualities of a remaining release agent on the joint surface that is less than 5 as an amount of boron measured by fluorescence X-ray analysis and a crystal grain straining region that is equal to or less than 40% or crystal grain straining equal to or less than 0.03%.

Sakuraba does not disclose nor suggest that varying honing conditions to affect the crystal grain straining due to that honing or grinding plus the remaining release agent would create a base plate for a power module that is highly reliable under circumstances in which temperature significantly changes. For these reasons, claims 1 and 2 of Applicant's invention would not have been obvious to one skilled in the art and Applicant respectfully requests that this rejection be withdrawn.

Because claims 1 and 2 are not obvious in view of the above arguments, claims 3-4 and 15-16 are also not obvious as they are dependent claims.

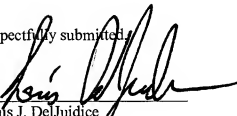
CONCLUSION

In view of the above remarks, it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining, which the Examiner believes could be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below

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Respectfully submitted,



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